

Injuries and Illnesses of Vietnam War POWs Revisited:

IV. Air Force Risk Factors

LT Saima Raza, MSC, USN, Jeffrey L. Moore, John P. Albano, and A. Fred Wells

Operation Homecoming (O/H), the negotiated release of 566 US Servicemen held as prisoners of war (POWs) in Vietnam for as long as nine years, began in February 1973. During the months that followed, enemy forces released 138 Navy, 26 Marine Corps, 77 Army, and 325 Air Force Repatriated POWs (RPWs).

As a part of O/H (Thirteenth Air Force, 1973), medical and psychological conditions of all repatriates were documented in the Initial Medical Evaluation Form (IMEF), a 400 page, 29 section, standard protocol. Berg and Richlin (1977a,b and c) described the procedures and findings of the medical teams that examined and treated Navy, Marine Corps, and Army RPWs at Clark Air Force Base (Republic of the Philippines) and at eleven stateside military medical treatment facilities. Where appropriate, information was also presented concerning symptoms and conditions which occurred during captivity (as described in the history section of the IMEF). There was no such similar report or publication from the Air Force, aside from a detailed account of Air Force IMEF psychiatric findings (Ursano, et. al, 1981). Berg and Richlin (1977a) found that psychiatric illness was not in the top ten most common diagnoses among Navy repatriates, where helminthiasis, refractive error and hearing impairment were most common.

In their 1977 Navy, Marine Corps, and Army publications, Berg and Richlin emphasized documentation of the specific injury and illness diagnoses. We were interested in identifying risk factors that predisposed the RPW to various injuries and illnesses. In view of the small sample size of individual diagnoses, we evaluated the effects of captivity from the perspective of ICD9-CM diagnostic categories (i.e., systems level). From this perspective, the relationship between medical conditions observed at repatriation and various risk factors, also recorded in the IMEF, could be analyzed. These risk factors included age at time of captivity, length of captivity (months), length of solitary confinement (weeks), self-reported captivity medical problems, reported torture severity, and subjectively determined weight loss. Using this approach, we have previously found that the typical Navy, Army and Marine Corps repatriate received slightly more than twelve IMEF diagnoses during O/H (Raza, et.al, 2016a, b and c). Across the three services, the number of subjectively reported medical problems during captivity and torture severity were significantly correlated with the number of actual diagnoses upon repatriation, while the number of months spent in captivity was most significantly correlated with the number of subjectively reported captivity-related medical problems. Categorically, the most prevalent conditions in these groups were related to infections, injuries/trauma and conditions involving the nervous system or special senses. When predicting either number of diagnoses in each category or the presence/absence of a categorical diagnosis, we typically found the contribution of subjectively determined weight loss to be nonsignificant.

This report, which addresses the Air Force RPWs, is the last in a series of four reports. The purpose of this present study is to look, for the first time ever, at the Air Force IMEF diagnoses and explore the relationship between the number of diagnosis at repatriation and the various risk factors. We still hypothesized that these risk factors would predict both the grand total of IMEF diagnoses across categories and the presence of any diagnoses within specific categories. We also hypothesize that the distribution of the top 10 Navy diagnoses reported by Berg and Richlin (1977a) will be the same for the Air Force repatriates and that an average of 12 diagnoses would be observed.

Methods

Data from all 325 Air Force RPWs recorded in the IMEF were available for analysis. But because there was no evidence of any analysis similar to the Berg and Richlin analyses of the USN, USMC, and USA, we created an electronic database referring to individual microfilm copy of the original 400 page IMEF on each Air Force repatriate. All available information regarding diagnoses, age at time of captivity, length of captivity (months), length of solitary confinement (weeks), self-reported captivity medical problems, reported torture severity, and subjectively determined weight loss were retrieved and verified by the entire research team for ICD9-CM categorical codification. Next, each RPW diagnosis was coded to an ICD9-CM category. We then tabulated the number of diagnoses per category, excluding diagnoses relating

to Pregnancy and Certain Conditions Originating in the Perinatal Period (i.e., ICD9-CM codes 740-779), which were non-existent in our sample. The presence or absence of diagnoses within a category was also tabulated for each of the repatriates. Using Berg and Richlin's reported top 10 diagnoses for the Navy (1977a); we recorded the same for the Air Force repatriates. We did this because both groups were predominantly aviators imprisoned in North Vietnam.

Statistical analyses were performed using SPSS version 19. Pearson correlations were obtained between the number of IMEF total diagnoses and the six risk factors, while Spearman correlations were obtained between risk factors and the non-normally distributed number of diagnoses within each category. The relative contribution of the six risk factors to the prediction of the total number of IMEF diagnoses was explored using linear regression (complete entry and statistically-based forward entry). Similar linear regressions were performed to predict self-reported captivity medical problems using the other five risk factors. After identifying those ICD9-CM diagnostic categories with a prevalence of 25 to 60 percent (conditions that were neither rare nor ubiquitous), logistic regression was performed to evaluate the effectiveness of the risk factors in predicting presence or absence of conditions within these categories.

Results

The descriptive statistics for the Air Force repatriates are presented in Table 1. These 316 Officers and 9 Enlisted men were, on average, nearly 31 years old at the time of capture and were held prisoner for approximately four and a third years, 23 weeks of which were spent in solitary confinement. During captivity, they were frequently tortured (mean = 29 on a 25-item IMEF scale with a maximum score of 75), lost an average of 26% of their pre-captivity body weight and reported having concerns about seven medical problems during captivity (possible range 0 to 40).

Air Force repatriates received between 0 and 14 diagnoses at the time of repatriation (Table 2). The three ICD9-CM categories with the highest mean number of diagnoses within the Air Force cohort were Infectious, Ill Defined, and Injury Poisoning (in descending order). The prevalence of any diagnosis in each of these categories ranged from 80% to essentially 0% (Table 4). No Air Force repatriate had more than one diagnosis in three of the categories, but as many as two diagnoses were observed in the Mental category (overall prevalence of any Mental diagnosis was 27%).

As shown in Table 3, the total number of diagnoses at the time of repatriation was significantly correlated with five of the six risk factors, with Length of Captivity and Captivity-related Medical Problems explaining the 14% and 13% of the variance, respectively. At the level of individual diagnostic category, there were few significant correlations with risk factors and percent weight loss was not significantly correlated with any of the 15 ICD9-CM diagnostic categories. Age at time of capture was correlated with 2 of the diagnostic categories, while torture severity was correlated with only the number of diagnoses in the digestive category. Although significant, these three significant correlations only account for between 1% and 5% of the variance. The risk factors associated with Length of Captivity, Length of Solitary Confinement, and number of Captivity Related Medical Problems was the best predictors of the number of diagnoses at the individual categorical level, with significant correlation accounting between 2%-10% of the variance. The number of diagnoses in 7 of the 15 ICD9-CM categories, to include the Mental Illness category, was not significantly correlated with any of the 6 risk factors.

Complete linear regression analysis predicting the number of IMEF diagnoses using all six risk factors (Table 5a) resulted in a significant equation that accounted for 20.8% of the variance. Statistical linear regression allowing the forward addition of predictors (Table 6a) accounted for 19.5% of the variance using three of the risk variables. In each of these two regression equations, the relative contributions of Length of Captivity and Captivity related Medical Problems were consistent regardless of regression technique employed. Risk factors associated with captivity related weight loss was not used in any regression because of the previously mentioned lack of correlation.

A similar approach was utilized to predict the number of self-reported captivity medical problems using the remaining five risk factors. For this prediction, complete linear regression analysis resulted in a significant equation that accounted for 24.3% of the variance (Table 5b). Follow-up statistical linear regression allowing the forward addition of predictors (Table 6b) also produced a significant equation that accounted for 23.2% of the variance, relying upon only LOC and Torture Severity, with LOC being more than twice as in prediction of number of captivity related medical problems.

The ability of the risk factors to predict the presence or absence of diagnoses in those six ICD9-CM categories with midrange condition prevalence: injury (INJ): 60%, ill defined (ILL: 58%), neurosensory (NS: 58%), mental (MENT: 27%), skin (SKN: 26%, and digestive (DIG: 25%), was evaluated using logistic regression analysis (Table 7), where significant equations were obtained for NS and DIG. The logistic regression model for DIG approached statistical significance, accounting for approximately 16.9% of the variance and accurately categorizing 75.7% of the Air Force repatriates (base rate accuracy = 74.4%). For NS, the logistic regression model accounted for 14.4% of the variance and accurately categorizing 67.5% of the Air Force repatriates (base rate accuracy = 58.4%).

Spearman rank order correlation revealed a significant relationship between the USAF and the USN rankings of both the prevalence/absence of the fifteen categorical diagnoses ($\rho = 0.711$, $p = 0.003$) and the top-ten specific diagnoses ($\rho = 0.675$, $p = 0.032$) as shown in Table 8. Although no specific psychiatric illness appeared in the Navy list of the ten most prevalent diagnoses, sixteen percent of the USAF repatriates received an Adjustment Disorder diagnosis as part of O/H.

Discussion

To our knowledge, this study represents the first attempt to not only report an Air Force IMEF diagnoses summary, but also utilize captivity-related risk factors to predict repatriated POWs injury and illnesses, as measured by the number of diagnoses and the existence of categorical diagnoses. The strength of this study is a direct result of our access to the all of the original data obtained in 1973 (i.e., the IMEF). The only earlier published report (Ursano, et. al, 1981) addressed only psychiatric illness, with approximately 23 percent receiving a psychiatric diagnosis at the time of repatriation (categorized as either Psychoses, Neuroses, Adjustment Reaction, Personality Disorder, Marital/Occupational Problems, Psychophysiological Disorder, or Organic Brain Syndrome).

The Air Force RPWs were, indeed, much healthier than expected despite their lengthy and torturous captivity. After an average of nearly 53 months of captivity, these men subjectively reported an average of 7 captivity-related medical problems, while 5.6 diagnoses were made as a result of an extensive examination upon their repatriation. Objective, examination-based, diagnoses were far more infrequent among USAF repatriates than in the other three services, thereby refuting one of our hypotheses. This finding occurred despite the use of the same IMEF and despite similar captivity-related risk factors, suggesting the possibility of a more conservative approach to diagnostic decision making among Air Force physicians. Our other two hypotheses were supported.

Having a fewer number of diagnoses per repatriate did not affect our ability to analyze the relative prevalence of categorical diagnoses, nor did it prohibit a correlational and regression-based analysis of the risk factors. As noted in our previous reports, the estimated percent of weight during captivity was of limited use. The large amount of missing weight-loss data may account for this finding, but this variable's measurement may be unreliable, especially were compared to length of captivity and age. The Air Force data confirmed that medical problems during captivity, age at the time of capture, lengths of captivity and solitary confinement and torture severity are reliable predictors of diagnosable illnesses upon repatriation. As expected, the total number of captivity-related medical problems subjectively reported by the Air Force RPWs and length of captivity were the best predictor of the number of physician-made diagnoses, followed length of solitary confinement and age at the time of capture. Air Force repatriates who were older, held longer, and had more subjective complaints demonstrated a wider range of illnesses and injuries following extensive objective evaluation. Likewise, the number of captivity-related medical problems increased with repatriate age and captivity duration. The USAF data were also consistent with the other services regarding the most prevalent categories: infections, injuries and ill-defined conditions. Despite the previously mentioned conservative approach to medical diagnoses, a more liberal approach to psychiatric diagnosis may have resulted in the increased diagnosis of Adjustment Disorder (to include "resolved and "resolving" cases) among USAF repatriates.

Despite our unique approach, there appear to be several limitations to this study. Most Air Force repatriates were officer aviators and therefore, prior to captivity, were highly educated, met a higher standard of health, and had completed an arduous mock-captivity training course that emphasized survival and resistance. Other limitations include the restricted range of pathology, the lack of comparison to

repatriates from other services and this group's apparent conservative approach to both symptom reporting and objective diagnosis. We will attempt to address these issues in future research.

References

1. Berg, S.W. & Richlin, M. (1977a). Injuries and illnesses of Vietnam War POWs. I. Navy POWs. *Military Medicine*, 142, 514-518.
2. Berg, S.W. & Richlin, M. (1977b). Injuries and illnesses of Vietnam War POWs. II. Army POWs. *Military Medicine*, 142, 598-602.
3. Berg, S.W. & Richlin, M. (1977c). Injuries and illnesses of Vietnam War POWs. III. Marine Corps POWs. *Military Medicine*, 142, 678-680.
4. Center for Prisoner of War Studies (1972). *Repatriated Prisoner of War Initial Medical Evaluation Forms*. Department of Defense. Washington, D.C.
5. IBM Corporation (2010). IBM SPSS Statistics for Windows, Version 19.0. IBM Corporation: Armonk, New York.
6. National Center for Health Statistics (2010). International Classification of Diseases and Injuries, Ninth Edition Clinical Modification (ICD-9-CM). Retrieved from ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/ICD-9/2010/ucod.txt.
7. Raza, S.S, Moore, J. L., and Albano, J.P. Injuries and Illnesses of Vietnam War POWs Revisited: I. Navy Risk Factors (2016a). ADA Number: 626171, Defense Technical Information Center, Ft. Belvoir, Virginia.
8. Raza, S.S, Moore, J. L., and Albano, J.P. Injuries and Illnesses of Vietnam War POWs Revisited: II. Army Risk Factors (2016b). ADA Number: 626687, Defense Technical Information Center, Ft. Belvoir, Virginia.
9. Raza, S.S, Moore, J. L., and Albano, J.P. Injuries and Illnesses of Vietnam War POWs Revisited: III. Marine Corps Risk Factors (2016c). ADA Number: 626659, Defense Technical Information Center, Ft. Belvoir, Virginia.
10. Thirteenth Air Force (1973). *Joint Homecoming Reception Center (JHRC) After Action Report*. Department of the Air Force: San Francisco, California.
11. Ursano, R.J., Boydston, J.A., and Wheatley, R.D. (1981). Psychiatric Illness in U.S. Air Force Viet Nam Prisoners of War: A Five-Year Follow-up. *American Journal of Psychiatry*, 138, 310-314.

Table 1
USAF Demographics
(n = 325)

| Variable | Min | Max | Mean | StdDev |
|-----------------|-----|------|-------|--------|
| Age_TOC | 19 | 47 | 31.01 | 5.66 |
| LOCm | 2 | 97 | 52.84 | 32.50 |
| LOSw | 0 | 360 | 23.16 | 38.48 |
| IMEF_tort | 0 | 66 | 28.75 | 13.27 |
| Weight Loss % | 2.6 | 53.6 | 25.65 | 10.60 |
| CapMedProbs | 0 | 29 | 7.12 | 4.66 |
| Percent Officer | | | 97.20 | |

Weight Loss % n = 223 CapMedProbs n = 305

Table 2
USAF IMEF ICD Descriptives
(n = 325)

| Variable | Min | Max | Mean | StdDev |
|-------------------|-----|-----|------|--------|
| Total # Diagnoses | 0 | 14 | 5.58 | 2.56 |
| Infectious | 0 | 5 | 1.16 | 0.87 |
| Neoplasms | 0 | 1 | 0.01 | 0.08 |
| Endocrine | 0 | 2 | 0.05 | 0.22 |
| Blood | 0 | 1 | 0.01 | 0.06 |
| Mental | 0 | 2 | 0.28 | 0.48 |
| Nervous & Senses | 0 | 4 | 0.93 | 0.99 |
| Circulatory | 0 | 2 | 0.21 | 0.44 |
| Respiratory | 0 | 2 | 0.12 | 0.34 |
| Digestive | 0 | 3 | 0.29 | 0.54 |
| Genitourinary | 0 | 2 | 0.08 | 0.29 |
| Skin | 0 | 2 | 0.30 | 0.53 |
| Musculoskeletal | 0 | 3 | 0.22 | 0.52 |
| Congenital | 0 | 1 | 0.01 | 0.11 |
| Ill Defined | 0 | 5 | 0.98 | 1.11 |
| Injury Poisoning | 0 | 4 | 0.94 | 0.99 |

Table 3
USAF Correlations
(n = 325)

| Variable | Age_TOC | LOCm | LOSw | IMEF_tort | Weight Loss % | CapMedProbs |
|-------------------|--------------|--------------|--------------|--------------|---------------|--------------|
| Total # Diagnoses | 0.203 | 0.369 | 0.229 | 0.108 | 0.002 | 0.358 |
| Infectious | 0.017 | 0.215 | 0.174 | 0.075 | 0.045 | 0.075 |
| Neoplasms | 0.028 | 0.013 | 0.057 | 0.095 | 0.114 | -0.005 |
| Endocrine | -0.012 | 0.089 | 0.112 | 0.082 | -0.080 | 0.105 |
| Blood | -0.031 | -0.093 | -0.088 | -0.094 | -0.113 | 0.055 |
| Mental | 0.025 | 0.059 | 0.065 | 0.039 | 0.042 | 0.095 |
| Nervous & Senses | 0.222 | 0.210 | 0.225 | 0.090 | -0.076 | 0.288 |
| Circulatory | 0.126 | 0.180 | 0.123 | 0.037 | -0.107 | 0.069 |
| Respiratory | 0.057 | -0.017 | -0.016 | 0.064 | -0.106 | 0.187 |
| Digestive | 0.066 | 0.313 | 0.248 | 0.113 | 0.039 | 0.162 |
| Genitourinary | 0.006 | 0.131 | 0.108 | 0.008 | -0.034 | 0.062 |
| Skin | -0.048 | -0.028 | -0.060 | -0.097 | -0.032 | -0.002 |
| Musculoskeletal | 0.071 | 0.095 | 0.104 | 0.041 | 0.022 | 0.099 |
| Congenital | 0.023 | 0.043 | 0.011 | -0.005 | -0.098 | -0.045 |
| Ill Defined | 0.020 | 0.152 | 0.099 | 0.104 | 0.015 | 0.175 |
| Injury Poisoning | 0.101 | -0.012 | -0.019 | -0.029 | -0.029 | 0.115 |

BOLD = Significant

n = 223

n = 299

Table 4
USAF IMEF Any Categorical Diagnosis
(n = 325)

| Variable | Presence (%) |
|------------------|--------------|
| Infectious | 79.7 |
| Neoplasms | 0.6 |
| Endocrine | 4.3 |
| Blood | 0.3 |
| Mental | 26.7 |
| Nervous & Senses | 58.2 |
| Circulatory | 19.4 |
| Respiratory | 11.4 |
| Digestive | 25.2 |
| Genitourinary | 7.1 |
| Skin | 25.8 |
| Musculoskeletal | 18.8 |
| Congenital | 1.2 |
| Ill Defined | 58.2 |
| Injury Poisoning | 60.0 |

Table 5
USAF Complete Regressions
(n = 305)

a. IMEF $R^2 = 0.208$ $SEE = 2.27$ $p < 0.001$

| | B | Std Error | Beta | p | part |
|-------------|-------|-----------|--------|--------|--------|
| (Constant) | 2.280 | 0.753 | n/a | 0.003 | n/a |
| Age_TOC | 0.062 | 0.024 | 0.139 | 0.011 | 0.130 |
| LOCm | 0.020 | 0.005 | 0.262 | <0.001 | 0.221 |
| LOSw | 0.005 | 0.004 | 0.070 | 0.234 | 0.059 |
| IMEF_tort | 0.023 | 0.011 | -0.120 | 0.044 | -0.099 |
| CapMedProbs | 0.126 | 0.032 | 0.231 | <0.001 | 0.198 |

b. CapMedProbs $R^2 = 0.243$ $SEE = 4.07$ $p < 0.001$

| | B | Std Error | Beta | p | part |
|------------|-------|-----------|-------|--------|-------|
| (Constant) | 0.675 | 1.350 | n/a | 0.618 | n/a |
| Age_TOC | 0.071 | 0.043 | 0.088 | 0.099 | 0.083 |
| LOCm | 0.053 | 0.008 | 0.370 | <0.001 | 0.323 |
| LOSw | 0.007 | 0.007 | 0.056 | 0.330 | 0.047 |
| IMEF_tort | 0.045 | 0.020 | 0.130 | 0.025 | 0.117 |

Table 6
USAF Forward Regressions
(n = 305)

a. IMEF $R^2 = 0.195$ $SEE = 2.281$ $p < 0.001$

| | B | Std Error | Beta | p | part |
|-------------|-------|-----------|-------|--------|-------|
| (Constant) | 1.937 | 0.729 | n/a | 0.010 | n/a |
| LOCm | 0.019 | 0.005 | 0.244 | <0.001 | 0.225 |
| CapMedProbs | 0.120 | 0.032 | 0.220 | <0.001 | 0.190 |
| Age_TOC | 0.059 | 0.023 | 0.133 | 0.012 | 0.131 |

b. CapMedProbs $R^2 = 0.232$ $SEE = 4.09$ $p < 0.001$

| | B | Std Error | Beta | p | part |
|------------|-------|-----------|-------|--------|-------|
| (Constant) | 2.570 | 0.583 | n/a | 0.108 | n/a |
| LOCm | 0.056 | 0.008 | 0.390 | <0.001 | 0.354 |
| IMEF_tort | 0.056 | 0.019 | 0.163 | 0.004 | 0.15 |

Table 7
USAF Logistic Regression

a.

| | INJ | ILL | NS |
|------------------------|--------|-------|--------|
| Baseline % Correct | 0.597 | 0.584 | 0.584 |
| Equation % Correct | 0.590 | 0.600 | 0.675 |
| % Difference | -0.007 | 0.016 | 0.091 |
| False Positives | 119 | 88 | 65 |
| False Negatives | 6 | 34 | 34 |
| PPV | 0.60 | 0.62 | 0.69 |
| NPV | 0.40 | 0.53 | 0.65 |
| Model Significance (p) | 0.510 | 0.031 | <0.001 |
| Nagelkerke R-Square | 0.019 | 0.053 | 0.144 |

b.

| | MEN | SKN | DIGEST |
|------------------------|-------|-------|--------|
| Baseline % Correct | 0.741 | 0.734 | 0.744 |
| Equation % Correct | 0.744 | 0.734 | 0.757 |
| % Difference | 0.003 | 0.000 | 0.013 |
| False Positives | 0 | 0 | 2 |
| False Negatives | 78 | 81 | 72 |
| PPV | 1.00 | N/A | 0.75 |
| NPV | 0.74 | 0.73 | 0.76 |
| Model Significance (p) | 0.299 | 0.396 | <0.001 |
| Nagelkerke R-Square | 0.029 | 0.024 | 0.169 |

Table 8
USAF Prevalence of Top USN Diagnoses

| | Diagnosis | USN Percent | USAF Percent |
|----|-----------------------------------|----------------|-----------------|
| 1 | Helminthiasis | 88 | 69 |
| 2 | Refractive Errors | 52 | 27 |
| 3 | Hearing Impairment | 48 | 28 |
| 4 | Amoebiasis | 38 | 3 |
| 5 | Hemorrhoids | 32 | 12 |
| 6 | Spondylitis Osteoarthritis | 28 | 3 |
| 7 | Fractured Vertebrae (Compression) | 26 | 20 |
| 8 | Dermatophytosis | 24 | 25 |
| 9 | Dislocated & Deranged Knee | 16 | 6 |
| 10 | Old Granulomatous Disease | 15 | 1 |